Listing of All Claims Including Current Amendments

1. (currently amended) A method of producing nitrogenous semiconductor crystal materials of the form $A_XB_YC_ZN_VM_W$ in the nature of strata on a wafer, wherein A, B and C represent elements of elemental group II or group III, N represents nitrogen, M represents an element of elemental group V or group VI, and X, Y, Z, V and W represent the mol fraction of each element in $A_XB_YC_ZN_VM_W$, in a reactor comprising a reaction chamber defined by a set of chamber walls and an upper side and lower side thereof, a first wafer support positioned within the reaction chamber, a gas inlet through which process gases flow into the reaction chamber, a gas mixing system in fluid communication with the reaction chamber, a gas outlet through which the process gases are discharged from the reaction chamber, a second wafer support positioned on the first wafer support, a heating system for heating the first wafer support, and a controller for controlling the process gases and the reaction chamber; the method comprising:

determining a plurality of temperatures selected from the group consisting of the temperature of the gas inlet, T_1, the temperature of the chamber walls, T_2, the temperature of the first wafer support, T_3, the temperature of the second wafer support, T_4, the temperature of the gas outlet, T_5, the temperature of the gas mixing system, T_6, the temperature of the upper side of the reaction chamber, T_7, and the temperature of the heating system, T_8;

determining the temporal variation of at least one of the plurality of temperatures;

calculating at least one gradient between ~~at least two of the plurality of temperatures~~ <u>a set of temperatures, the set of temperatures selected from the group consisting of the temperatures of the gas outlet and the wafer supports, the temperatures of the gas mixing system and the gas inlet, and the temperatures of the upper side of the reaction chamber and the first wafer support</u>;

controlling the plurality of temperatures, using the determined plurality of temperatures[[,]] <u>and</u> the determined at least one temporal variation~~, and the at least one temperature gradient,~~ in correspondence with a plurality of numerically simulated temperature variation profiles; and

controlling process parameters in the reaction chamber.

2. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling the temperature of the gas inlet, T_1, so as to be below a condensation temperature of the process gases.

3. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling the temperature of the chamber walls, T_2, so as to be equal to the temperature of the first wafer support, T_3.

4. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling the temperature of the first wafer support, T_3, as a constant temperature.

5. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling the temperature of the second wafer support, T_4, in correspondence with the temperature of the first wafer support, T_3.

6. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling the temperature of the gas outlet, T_5, to a value smaller than the value of the temperature of the second wafer support, T_4, and the temperature the first wafer support, T_3.

7. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling the temperature of the gas mixing system, T_6, as a constant temperature smaller than the temperature of the gas inlet, T_1.

8. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling the temperature of the upper side of the reaction chamber, T_7, as a constant temperature in correspondence with the temperature of the first wafer support, T_3.

9. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling the temperature of the heating system, T_8, as a constant temperature in correspondence with the temperature of the first wafer support, T_3.

10. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling a temperature-dependent gas flow variation.

11. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling a temperature-dependent total pressure variation in the reaction chamber.

12. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling a temperature-dependent principal carrier gas variation in the reaction chamber.

13. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises controlling temperature-dependent interrupts in the production process.

14. (previously presented) The method according to Claim 1 further comprising applying the semiconductor materials to be produced on a mechanical carrier of a semiconductor of group IV, a semiconductor of groups III-V, oxides or any other material resistant to temperatures and the process gases.

15. (previously presented) The method according to Claim 14 further comprising pre-treating said mechanical carrier by applying lines, dots, or by carrying out other steps for surface treatment, or by partially covering the surface with other materials or material components.

16. (previously presented) The method according to Claim 1 further comprising a two-stage application of pre-processed $A_XB_YC_ZN_VM_W$ materials.

17. (previously presented) The method according to Claim 1 wherein controlling the plurality of temperatures comprises employing a temperature-controlled injector.

18. (withdrawn) Device for producing nitrogenous semiconductor crystal materials and particularly of strata on wafers of the form $A_XB_YC_ZN_VM_W$, wherein A, B, C represent elements of group II or III, N represents nitrogen, M represents an element of group V, with the exception of N, or group VI, and X, Y, Z, V, W represent the mol fraction of each element in this compound, comprising

- a reaction chamber wherein at least one wafer support is disposed,
- at least one gas inlet through which the process gases flow into said reaction chamber in a controlled succession,
- possibly a gas mixing system,

- a gas outlet through which the process gases are discharged again after they have flown through said reaction chamber, and
- a controller that controls or controls in a closed loop, respectively, the type or the composition of the in-flowing process gases and the temperature of the wafer, as well as possibly further parts of said reaction chamber,

characterised in that for the selective adjustment of the characteristics of the materials so produced, said controller adjusts, in addition to the control of the absolute temperature of the wafer and/or at least one part of said reaction chamber, also the temperature variation of at least this part or another part of said reaction chamber, e.g. the gas inlet T_1, the chamber walls T_2, the principal wafer support T_3, rotating individual wafer supports T_4, the gas outlet T_5, said gas mixing system T_6, the upper side of said reaction chamber T_7 and/or said heating system T_8 with temperature variation profiles within the range of seconds in such a way that the variation of the process parameters so caused results in a dynamic control of the thermal processes leading to the production of the materials.

19. (previously presented) The method of Claim 4 wherein controlling the plurality of temperatures comprises controlling the temperature of the first wafer support, T_3, up to about 1600 degrees centigrade.

20. (previously presented) The method of Claim 19 wherein controlling the plurality of temperatures comprises controlling the temperature of the first wafer support, T_3, with temperature variations of up to 250 degrees per minute.

21. (previously presented) The method of Claim 4 wherein controlling the plurality of temperatures comprises controlling the temperature of the first wafer support to an accuracy of 0.1 degrees centigrade.

22. (previously presented) The method of Claim 6 wherein the temperature of the second wafer support, T_4 is less than the temperature of the first wafer support, T_3.

23. (currently amended) A method of adjusting material characteristics of semiconductor compounds of the form $A_XB_YC_ZN_VM_W$ in the nature of strata on a wafer, wherein A, B and C represent elements of elemental group II or group III, N represents nitrogen, M represents an element of elemental group V or group VI, and X, Y, Z, V and W represent the mol fraction of each element in $A_XB_YC_ZN_VM_W$, in a reactor comprising a reaction chamber defined by a set of chamber walls and an upper side and lower side thereof, a first wafer support positioned within the reaction chamber, a gas inlet through which process gases flow into the reaction chamber, a gas mixing system in fluid communication with the reaction chamber, a gas outlet through which the process gases are discharged from the reaction chamber, a second wafer support positioned on the first wafer support, a heating system for heating the first wafer support, and a controller for controlling the process gases and parts of the reaction chamber; the method comprising:

determining a plurality of temperatures selected from the group consisting of the temperature of the gas inlet, T_1, the temperature of the chamber walls, T_2, the temperature of the first wafer support, T_3, the temperature of the second wafer support, T_4, the temperature of the gas outlet, T_5, the temperature of the gas mixing system, T_6, the temperature of the upper side of the reaction chamber, T_7, and the temperature of the heating system, T_8;

determining the temporal variation of at least one of the plurality of temperatures;

calculating at least one gradient between ~~at least two of the plurality of temperatures~~ a set of temperatures, the set of temperatures selected from the group consisting of the temperatures of the gas outlet and the wafer supports, the temperatures of the gas mixing system and the gas inlet, and the temperatures of the upper side of the reaction chamber and the first wafer support; and

controlling the plurality of temperatures, using the determined plurality of temperatures[[,]] and the determined at least one temporal variation~~, and the at least one temperature gradient,~~ in correspondence with a plurality of numerically simulated temperature variation profiles.

24. (previously presented) The method of Claim 23 wherein the material characteristics comprise an electron concentration of up to 10^{20} cm^{-3}.

25. (previously presented) The method of Claim 23 wherein the material characteristics comprise a hole concentration of up to 10^{18} cm^{-3}.

26. (previously presented) A quantum well produced by the method of Claim 23.

27. (previously presented) The quantum well of Claim 26 wherein the quantum well is InGaN/GaN.

28. (previously presented) A semiconductor material having a $A_{1X}B_{1Y}C_{1Z}N_{1V}M_{1W}$/ $A_{2X}B_{2Y}C_{2Z}N_{2V}M_{2W}$ heterostructure produced from the method of Claim 23.

29. (cancelled).

30. (currently amended) A method of adjusting material characteristics of semiconductor compounds of the form $A_XB_YC_ZN_VM_W$ in the nature of strata on a wafer, wherein A, B and C represent elements of elemental group II or group III, N represents nitrogen, M represents an element of elemental group V or group VI, and X, Y, Z, V and W represent the mol fraction of each element in $A_XB_YC_ZN_VM_W$, in a reactor comprising a reaction chamber defined by a set of chamber walls and an upper side and lower side thereof, a first wafer support positioned within the reaction chamber, a gas inlet through which process gases flow into the reaction chamber, a gas mixing system in fluid

communication with the reaction chamber, a gas outlet through which the process gases are discharged from the reaction chamber, a second wafer support positioned on the first wafer support, a heating system for heating the first wafer support, and a controller for controlling the process gases and parts of the reaction chamber; the method comprising:

determining a plurality of temperatures selected from the group consisting of the temperature of the gas inlet, T_1, or the temperature of the chamber walls, T_2, or the temperature of the first wafer support, T_3, or the temperature of the second wafer support, T_4;

determining the temporal variation of at least one of the plurality of temperatures;

calculating at least one gradient between ~~at least two of the plurality of temperatures~~ a set of temperatures, the set of temperatures selected from the group consisting of the temperatures of the gas outlet and the wafer supports, the temperatures of the gas mixing system and the gas inlet, and the temperatures of the upper side of the reaction chamber and the first wafer support; and

controlling the plurality of temperatures, using the determined plurality of temperatures[[,]] and the determined at least one temporal variation~~, and the at least one temperature gradient,~~ in correspondence with a plurality of numerically simulated temperature variation profiles.

31. (previously presented) The method of Claim 30 further comprising controlling each process temperature and at least one temporal variation thereof.

32. (previously presented) The method of Claim 30 wherein the temperature variation profiles are numerically simulated.

33. (previously presented) The method of Claim 30 further comprising controlling the temperature of the gas mixing system, T_6, and the temperature of the heating system, T_8.

34. (previously presented) The method of Claim 30 further comprising controlling the temperature of the gas outlet, T_5.

35. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling the temperature of the gas inlet, T_1, so as to be below a condensation temperature of the process gases.

36. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling the temperature of the chamber walls, T_2, so as to be equal to the temperature of the first wafer support, T_3.

37. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling the temperature of the first wafer support, T_3, as a constant temperature.

38. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling the temperature of the second wafer support, T_4, in correspondence with the temperature of the first wafer support, T_3.

39. (previously presented) The method according to Claim 34 wherein controlling the plurality of temperatures comprises controlling the temperature of the gas outlet, T_5, to a value smaller than the value of the temperature of the second wafer support, T_4, and the temperature the first wafer support, T_3.

40. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling the temperature of the gas mixing system, T_6, as a constant temperature smaller than the temperature of the gas inlet, T_1.

41. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling the temperature of the upper side of the reaction chamber, T_7, as a constant temperature in correspondence with the temperature of the first wafer support, T_3.

42. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling the temperature of the heating system, T_8, as a constant temperature in correspondence with the temperature of the first wafer support, T_3.

43. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling a temperature-dependent gas flow variation.

44. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling a temperature-dependent total pressure variation in the reaction chamber.

45. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling a temperature-dependent principal carrier gas variation in the reaction chamber.

46. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises controlling temperature-dependent interrupts in the production process.

47. (previously presented) The method according to Claim 30 further comprising applying the semiconductor materials to be produced on a mechanical carrier of a

semiconductor of group IV, a semiconductor of groups III-V, oxides or any other material resistant to temperatures and the process gases.

48. (previously presented) The method according to Claim 47 further comprising pre-treating said mechanical carrier by applying lines, dots, or by carrying out other steps for surface treatment, or by partially covering the surface with other materials or material components.

49. (previously presented) The method according to Claim 30 further comprising a two-stage application of pre-processed $A_XB_YC_ZN_VM_W$ materials.

50. (previously presented) The method according to Claim 30 wherein controlling the plurality of temperatures comprises employing a temperature-controlled injector.

51. (previously presented) The method of Claim 37 wherein controlling the plurality of temperatures comprises controlling the temperature of the first wafer support, T_3, up to about 1600 degrees centigrade.

52. (previously presented) The method of Claim 51 wherein controlling the temporal variations of the plurality of temperatures comprises controlling the temperature of the first wafer support, T_3, with temperature variations of up to 250 degrees per minute.

53. (previously presented) The method of Claim 37 wherein controlling the plurality of temperatures comprises controlling the temperature of the first wafer support to an accuracy of 0.1 degrees centigrade.

54. (previously presented) The method of Claim 39 wherein the temperature of the second wafer support, T_4 is less than the temperature of the first wafer support, T_3.

55. (previously presented) The method of Claim 30 wherein the material characteristics comprise an electron concentration of up to 10^{20} cm^{-3}.

56. (previously presented) The method of Claim 30 wherein the material characteristics comprise a hole concentration of up to 10^{18} cm^{-3}.

57. (previously presented) A quantum well produced by the method of Claim 30.

58. (previously presented) The quantum well of Claim 57 wherein the quantum well is InGaN/GaN.

59. (previously presented) A semiconductor material having a $A_{1X}B_{1Y}C_{1Z}N_{1V}M_{1W}$/ $A_{2X}B_{2Y}C_{2Z}N_{2V}M_{2W}$ heterostructure produced from the method of Claim 30.